

Restoration of Social-Ecological Systems of Tamiraparani Riverscape

A concise document
for the implementation



Joint initiative of the District Administration and Ashoka Trust for Research in Ecology and the Environment (ATREE) in partnership with Indian Institute for Human Settlements (IIHS) and local civil society organizations for the Restoration of TamiraSES.

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**The restoration
plan drawn
viewing
Tamiraparani as
complex-social-
ecological system**

At the joint initiative of Tirunelveli district administration, Ashoka Trust for Research and the Environment and Indian Institute of Human Settlements (IIHS) prepared Tamiraparani restoration plan. Ecological processes are linked closely to social systems and cannot be viewed in isolation.

The coupled-complex social-ecological-systems of Tamiraparani Riverscape has been broken down to meaningful sub-systems to build a restoration plan.

Restoration and Conservation is a continuous process of identifying problems, building restoration models at local scales that can be scaled up. Hotspots of concerns have been identified for Phase I of restoration plan based on ground survey, and consensus with the district administration. The models proposed are bottom-up, and stakeholders inclusive.

The Tamiraparani Social – Ecological System (SES)

The restoration targets will be implemented in phases. Each Phase will comprise pilots that serve as exemplars for scaling up in similar sections in the larger TamiraSES. Every phase alongside will also scope and identify the next set of drivers and prioritize targets for the following phase.

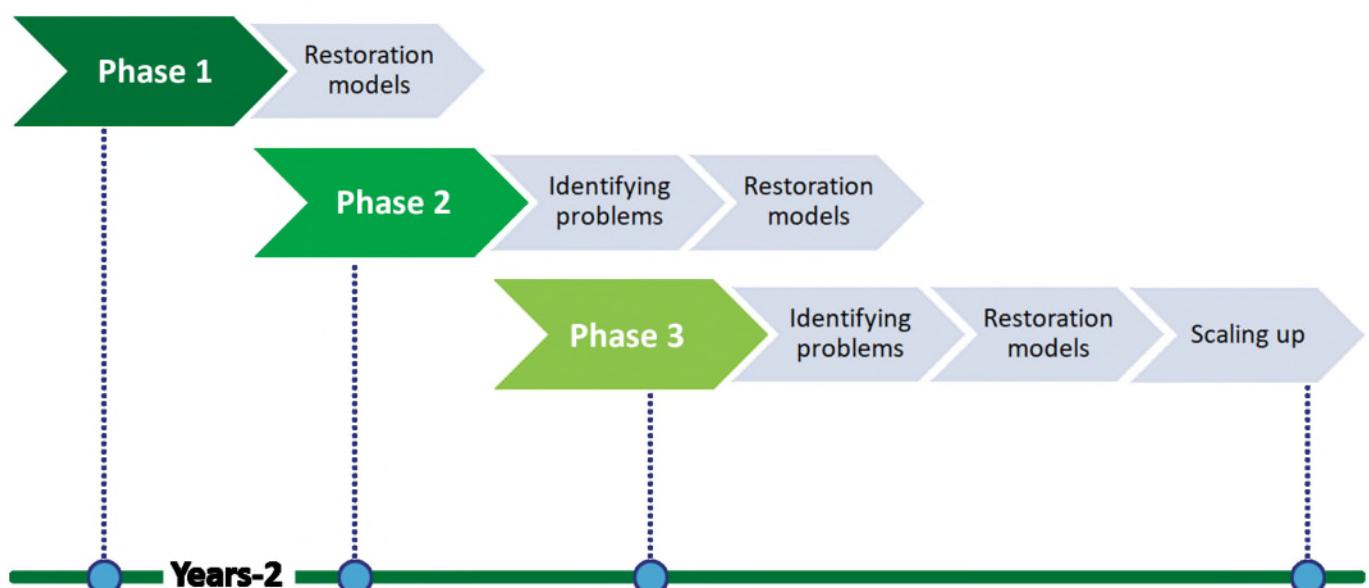


Figure 1. Proposed phases of restoration of Tamiraparani's Social - Ecological System

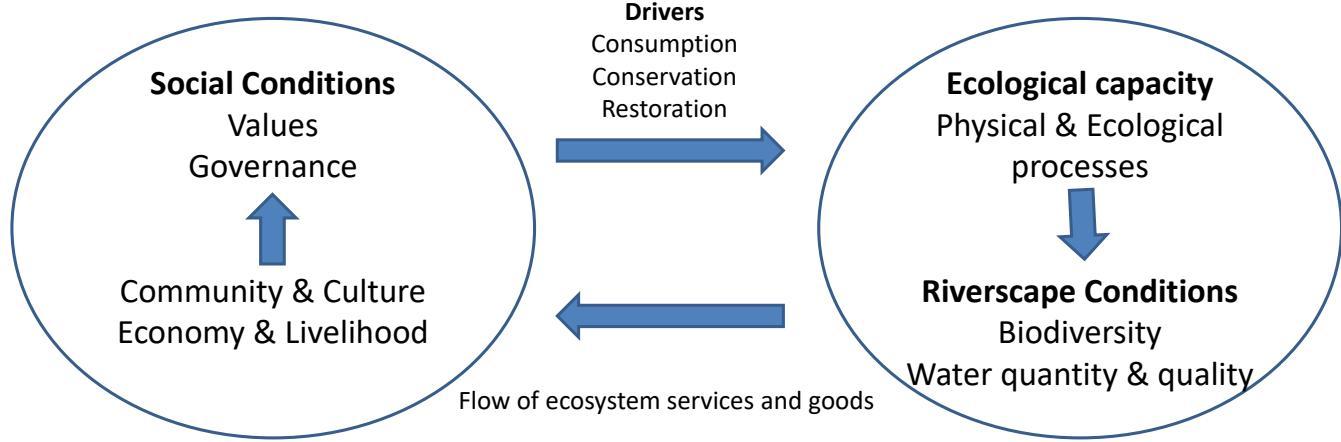


Figure 2. Interconnectness of Social and Ecological Systems

The five landscapes of Tamiraparani social ecological system (TamiraSES)

Tamiraparani—the only perennial river in Tamil Nadu—originates in the Pothigai Hills of Western Ghats in Tirunelveli District. The river flows through 5 landscapes or Ainthinai as described in Sangam age. Kurinji in the rugged hilly area and Mullai or forests at the foothills abutting villages where used for cattle grazing. The streams and rivers that join perennial Tamiraparani from the

mountains, support the lush green fields depicted by Marutham. The landscape further south breaks into Palai or desert of the Therikaadu region with deep red soil and sand dunes studded with palm trees. Tamiraparani reaches Neithal, the coastline with beaches interspersed with rocky outcrops and adds magnificence to the coastal landscape.

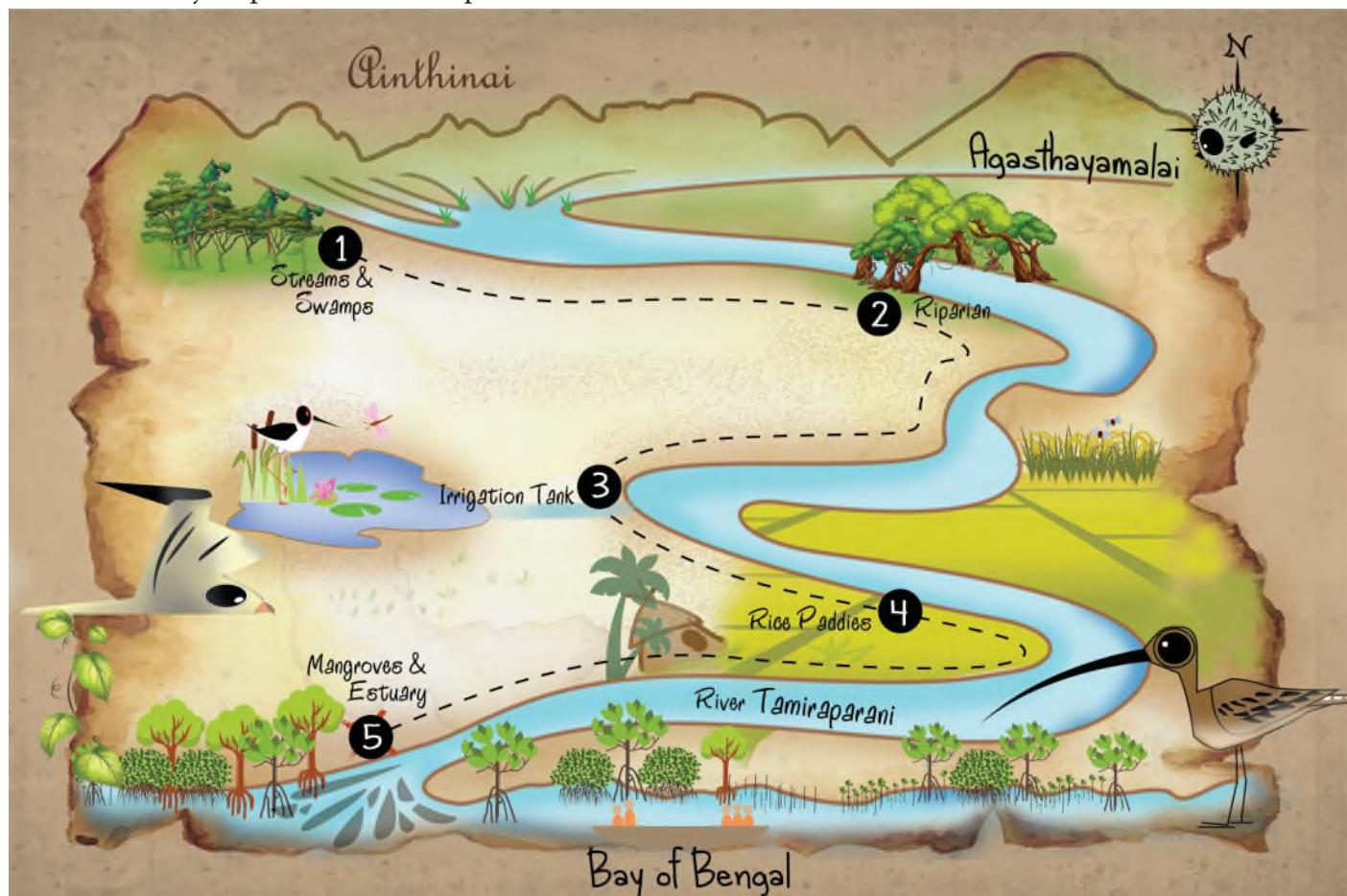


Figure 3. Five landscapes of Tamiraparani from it's origin at Pothigai Hills till it reaches the coast also called

(1) Kurinji; (2) Mullai; (3) Marutham; (4) Palai; (5) Neithal

Reservoirs and Command Area

Tamiraparani river has a perennial flow regulated by Papanasam and Servalar reservoirs, which impound the flows of Tamiraparani and Servalar rivers. Flows are regulated to meet irrigation demands and to produce hydroelectric power. The reservoir system in the landscape irrigates 40,000 ha of land in Tirunelveli and the neighbouring districts through eight anaicuts and 11 channels. The twin districts—Tirunelveli and Thoothukudi—are popularly known as the rice bowl and the banana basket of southern Tamil Nadu. There are two major crop cycles - Kar (south-west monsoon) and Pishanam (during the northeast monsoon).



Stresses on the riverscape

Tamiraparani even today evokes an emotion that binds the people, culture, and history. Numerous temples here stand as testimony to the glorious and prosperous bygone era. In recent times, the development pressures on the river system have led to poor river water quality and diminished ecological flows - impacting both human and ecosystem wel-

fare. While the Tamiraparani landscape, in general, appears water-rich, it faced severe drought in 2016 despite the diverse water storage systems in place. In 2021, in a contrasting situation, Tamiraparani was in spate, but did not lead to any major disaster in the region.

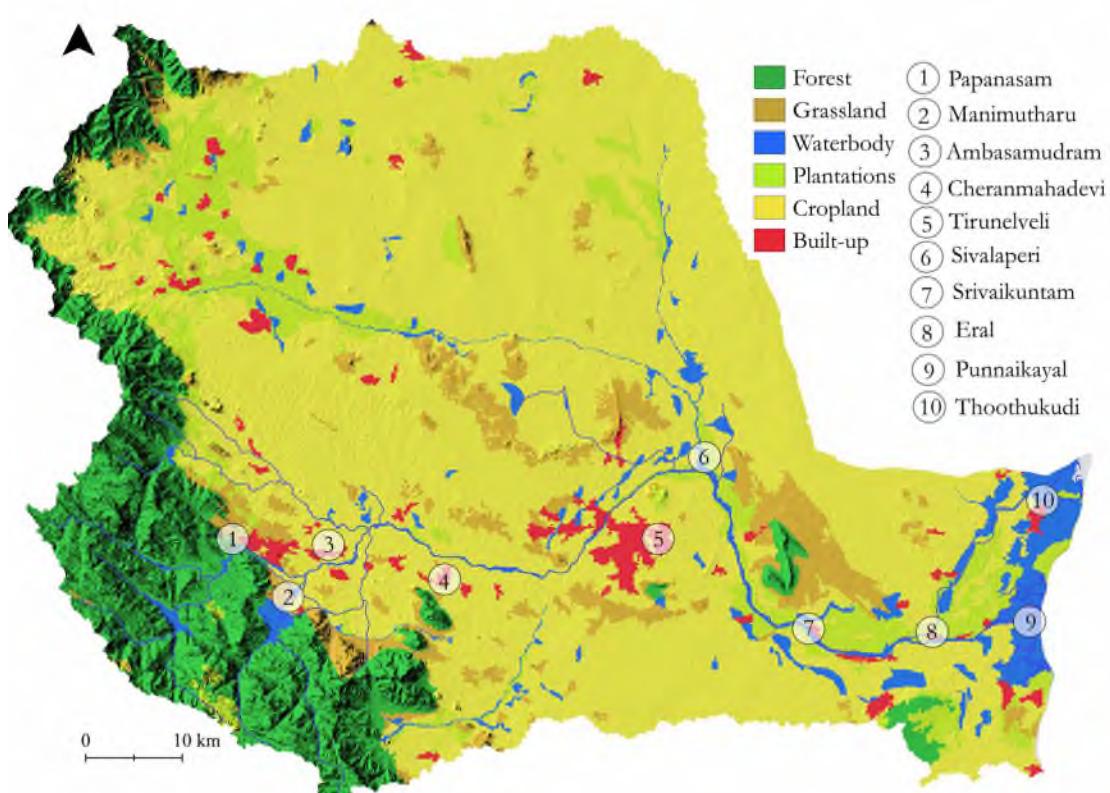


Figure 4. Major Land Use and Land Cover of Tamiraparani River Basin with increasing pressure on its SES by urbanization

Land-use changes have impacted the TamiraSES - urbanization is a major force that is shaping the TamiraSES. Settlements have been on the rise which has led to the shrinkage of agricultural land and water bodies.

Water has been the essence of these districts but current intense water-rich agriculture is fast expanding through newer canals and dam projects, furthering monoculture cropping. Until recently, nutritionally rich crops including groundnut, sorghum and ragi which were a significant part of the communities' staples which were less water demanding and are now being replaced with water-rich paddy cultivation. In addition to this, the demand for water for domestic needs and industries is predicted to double in 10 years which would mean a jump from 80 Cusec to 172 Cusec. The Tamiraparani river continues to be polluted by agriculture runoff, untreated sewage and organic waste from the villages and towns on its banks, in addition to industrial waste.

Observed restoration challenges in TamiraSES

- Reduced ecological flows downstream due to agriculture, domestic water and industry.
- Water quality degradation due to untreated domestic, agricultural, and commercial waste and inadequate waste treatment facilities .
- Reduced quality of life, human wellbeing, and livelihoods of the dependent communities

Goal

Restore the Social Ecological Systems of Tamiraparani river riverscape from head-waters to the estuary to enable conditions for native biodiversity to thrive and maintain and enhance multiple ecosystem services to local stake-holders.



Consensus building with District Administration

Table 1. Problems identified based on ground surveys and learnings through long term presence in the survey
 a. Solid Waste

	Issue/ Concern	Regulatory Control	Mapping	Monitoring	Study Scope	Severity -ATREE	Severity -GoTN
1	Brick Kilns	1	N	N	N	Low	Low
2	Garbage/ Landfills	2	N	N	Y	High	High
3	Ritual Pollution	2	Y	Y	Y	High	High
4	E-Waste	1	N	N	N	Low	Low
5	Packaging Material	2	N	N	N	Low	Low
6	Biohazardous	2	Y	N	Y	Low	High
7	Building Waste	1	N	N	N	Low	Low

Regulation	0	Regulation - Exists	1	Regulation - Needed/ More	2
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Table 2. b. Liquid Waste

	Issue/ Concern	Regulatory Control	Mapping	Monitoring	Study Scope	Severity -ATREE	Severity -GoTN
1	Industrail effluent	0	yes	yes	yes	High	To be assessed
2	Agriculture run off (Fert/Pest)	0	yes	yes	yes	high	high
3	Sewage	0	yes	yes	yes	high	high
4	Vehicle washing	2	yes	yes	No	Low	Low
5	Food waste	0	yes	yes	No	Low	Low
6	Animal waste (chicken)	0	yes	yes	yes	Low	Low
7	Cremation	0	yes	No	No	Low	Low
8	Grey water (not toilet)	0	yes	yes	Low	Low	Low
9	Open defecation	0	yes	yes	yes	High	High
10	Luandry	1	yes	yes	yes	Low	Low
11	Biohazardous	0	yes		yes	High	High

Regulation - Not sure	0	Regulation - Exists	1	Regulation - Needed/ More	2
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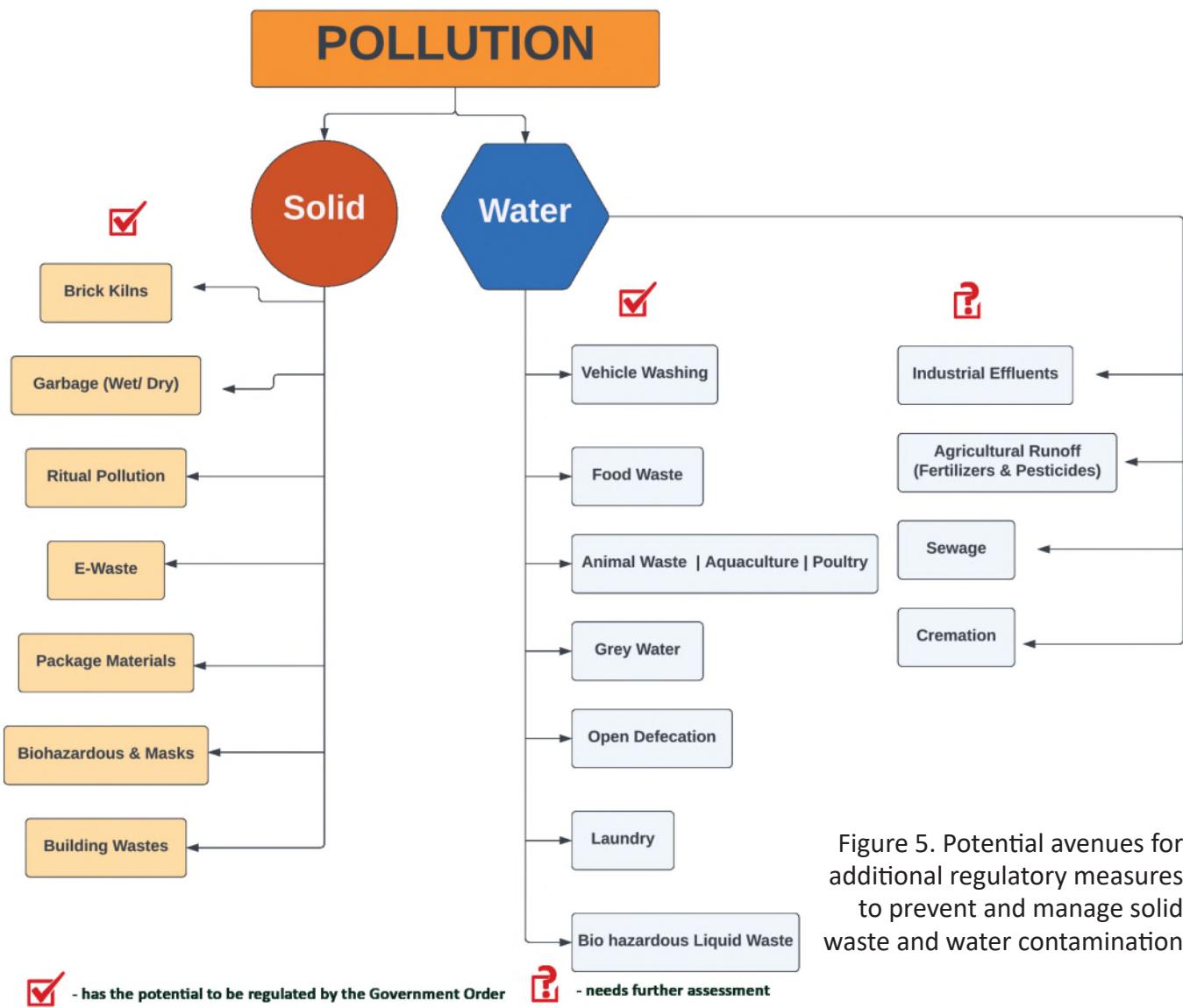


Figure 5. Potential avenues for additional regulatory measures to prevent and manage solid waste and water contamination

Development of restoration goals

- Top down approaches always have resistance from various stakeholders.
- Co-designing solutions, and developing long term strategies for operations and maintenance with various stakeholders is key to success.
- Co-building a reference for restoration of TamiraSES with stakeholders at local scales and river scale.

The most critical step to building specific restoration goals is the identification of problems which are often a combination of biophysical, economic, and socio-cultural factors. Identifying and consulting with various stakeholder groups at every step, therefore, is crucial for identifying the problems, co-designing the solutions, and developing long term strategies for operations and maintenance. Additionally, these goals also include sustainable livelihoods and resource-use by various communities dependent on Tamiraparani.

Combining water quality, hydrological, policy, and stakeholder analysis using a social-ecological framework, will allow for developing specific sub-goals covering three aspects - hydrological, ecological and livelihoods. Also, the problem-matched solutions can be either structural, nature-based, policy/regulation, or some combination of these.

Steps for Implementation

1. Zonation of the riverscape

Most of the river restoration is planned at the whole river scale which is non-cogent and often with little understanding of local conditions. Here we base our zonation on the first principles which are the stages of the River comprising the upper, middle, and final stages.

Zone 1. Ecosensitive zone

This zone is an area that is the buffer protected area where the Tamiraparni enters the human-dominated landscape comprising agriculture fields. This area comprises irrigation dams and hydel projects. Cultural space with temples on the banks along with agricultural run-off contributes to the pollution. The area is exceptionally rich in biodiversity.

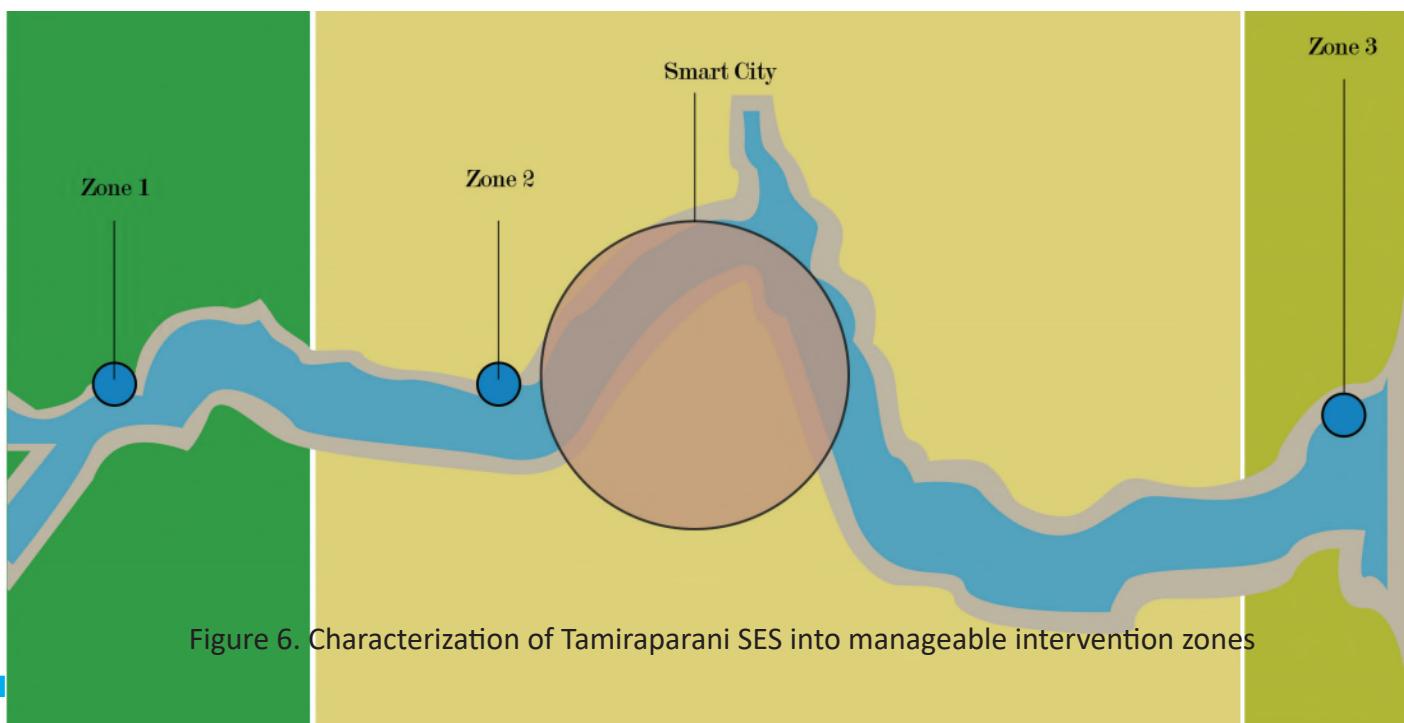
Zone 2. Ecological and Cultural cluster

The flow of the water is regulated through barrage and anaicuts through canals and a network of wetlands. Water consumption and abstraction are highest in this region. Growing towns contribute to domestic sewage, a large expanse of agriculture area of conventional practice contribute to runoff. Growing towns and industries in the region add to the pollution. Invasives such as water hyacinth is common in wetlands while Prosopis has colonised the river bed, enhancing evapotranspiration and thus reducing dry-season water levels and negatively impacting native riparian vegetation.

Smart city 'Tirunelveli' is present in Zone 3, grey and blackwater issue is very compelling here and is being addressed to some extent. Nurturing nature in the city is emerging as an important concept that links to human well being. Also, urban agriculture is emerging as critical in many cities. This is a need to integrate these into the current planning of Smart City. There are been an impetus to clean many wetlands jointly by district, citizenry and civil society bodies. The restoration should target a cluster of wetlands within the city for biodiversity support and other ecosystem services.

Zone 3. Estuarine system

This is an ecological critical zone and the health of the system will be an indicator of 'ecological flow'. It is critical to maintaining the ecological flow or the minimum flow in order to conserve the hydrological and ecological functions of their drainage networks. This is an area of unique biodiversity and fisheries and supports livelihoods. The efforts of the ongoing mangrove restoration will be evaluated.



2. Identification of points hotspots of impacts within Zones

Through a rapid survey and from the familiarity of the area types of impacts and the prominence in each zone were identified. The types of pollution will be overlayed on the actual location in the GIS/RS platform to arrive at spatially explicit information identifying hotspots under various pollution types and other impacts listed by us.

3. Co-building a reference for restoration of TamiraSES with stakeholders at local scales and river scale

Over time, anthropogenic influences through irrigation practices, waste management, and water withdrawals have affected the water quality and flows of the river Tamiraparani. At river scale, poor management of solid waste and wastewater over a period of time has deteriorated the water quality downstream. Similarly, water withdrawal regimes upstream have impacted the water flows downstream of the Tamiraparani. Some problems can be at local scale as in the ritual sites.

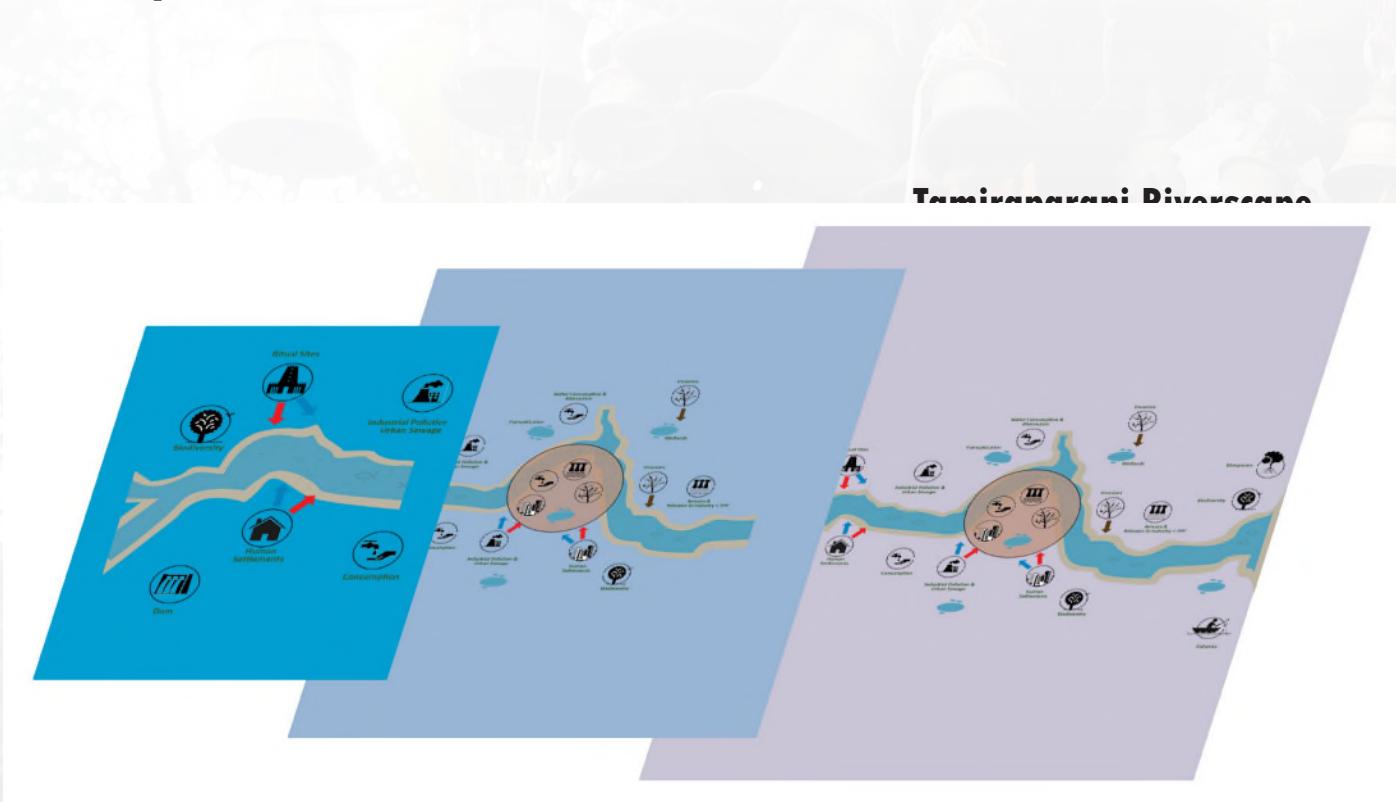


Figure 7. Problems need to be addressed in multiple-spatial scales

4. Our theory of change is continuous engagement with stakeholders to restore Tamiraparani riverscape through social ecological approach



6. Identifying the interested and influential stakeholders will be critical to have influence or effect on the project

Identifying influential stakeholders who are either influenced strongly by TamiraSES or can strongly influence it is a crucial step in reaching the restoration targets. Designing an inclusive process of working with the various groups of stakeholders, An inclusive approach also allows for improved engagement by the stakeholders - a crucial component of long term performance of restoration interventions. Active engagement can involve a range of potential participants, including citizen scientists, research scientists, conservation practitioners, and communities from the landscape who can be involved in the co-production of information and/or collaboration in management. The participation of stakeholders will make the effort genuine, representative, and inclusive, rather than a token gesture.

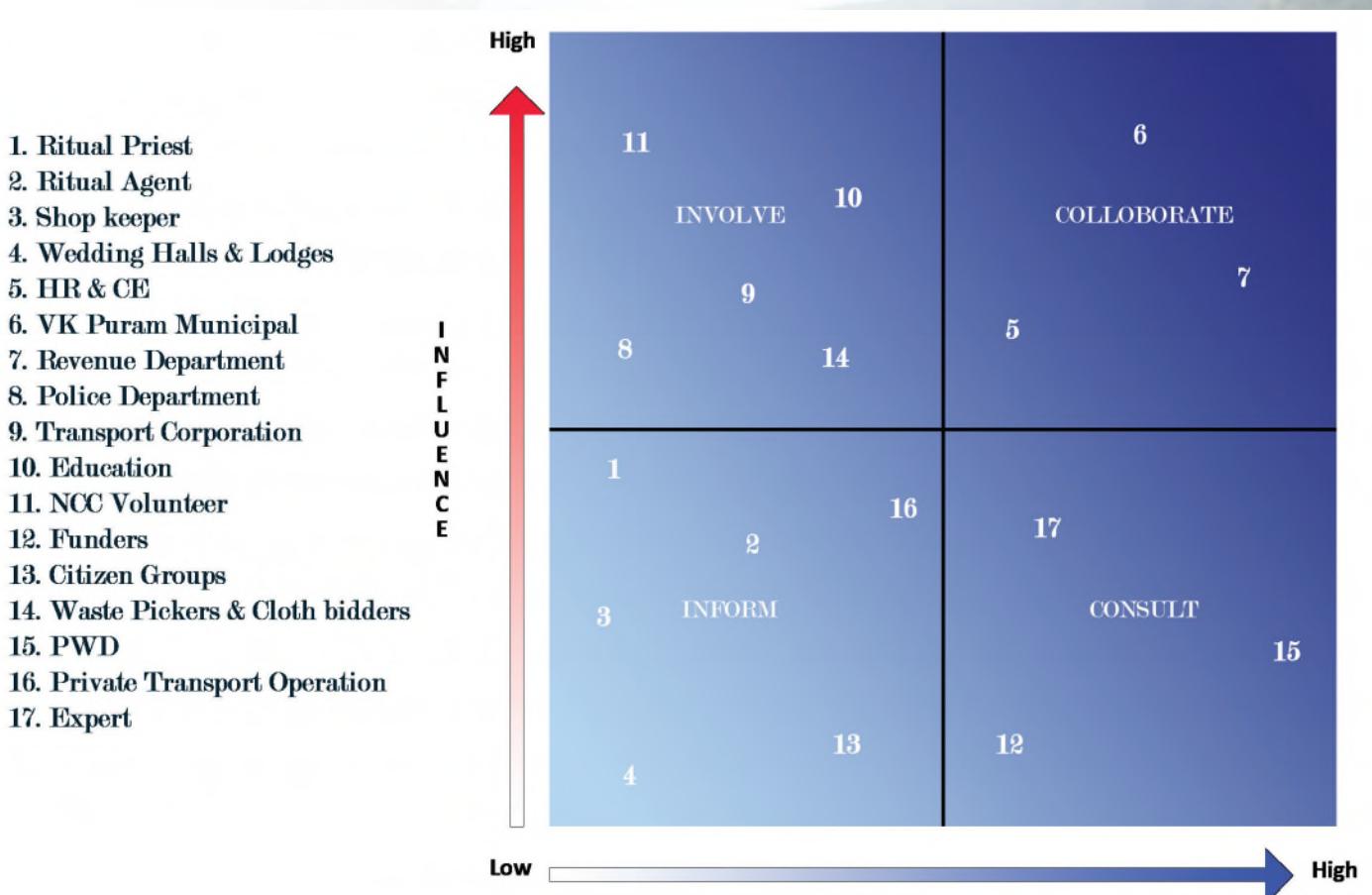


Figure 9. Hypothetical representation of Interested vs Influencer Plot for Papanasam SES



Phase 1

Timeline: 2 years

1. Ritual Hotspot

- Major problems
- Dumping old clothes
- Plastics
- Garbage
- Sewage
- Open defecation
- Traffic

2. Removal of invasive and restoration of riparian vegetation

- Volunteers of Nellai NeerValam will map the locations of invasives and document the existing native tree species.
- Post the survey site will be prioritized
- MGNREG will be engaged
- Nursery of selected species development with panchayat based on volunteers' survey checklist
- Planned riparian plantation which eco-hydrological considerations

3. Models of nature-based solution to address to nutrient enrichment effluent flow and agriculture run-off

Nainarkualm and Prancheri

- Removal of invasive (water hyacinth, Ipomea, prosopis etc.)
- Floating islands – nature based solution
- Assessing the intervention's response through water quantity and quality

4. Social ecological monitoring observatories – plan for the entire riverscape

Hydrological monitoring stations to be established in 2-3 sites in each zone -major wetland and one river stretch for water quality monitoring to estimate eg. nutrient loads.

Nellai NeerValam, volunteers, schools and colleges will be linked for monitoring which includes hydrological, biodiversity and patrolling for vandalisms and violations

Data collection. App development, visual output and interfacing with Nellai NeerValam dashboard

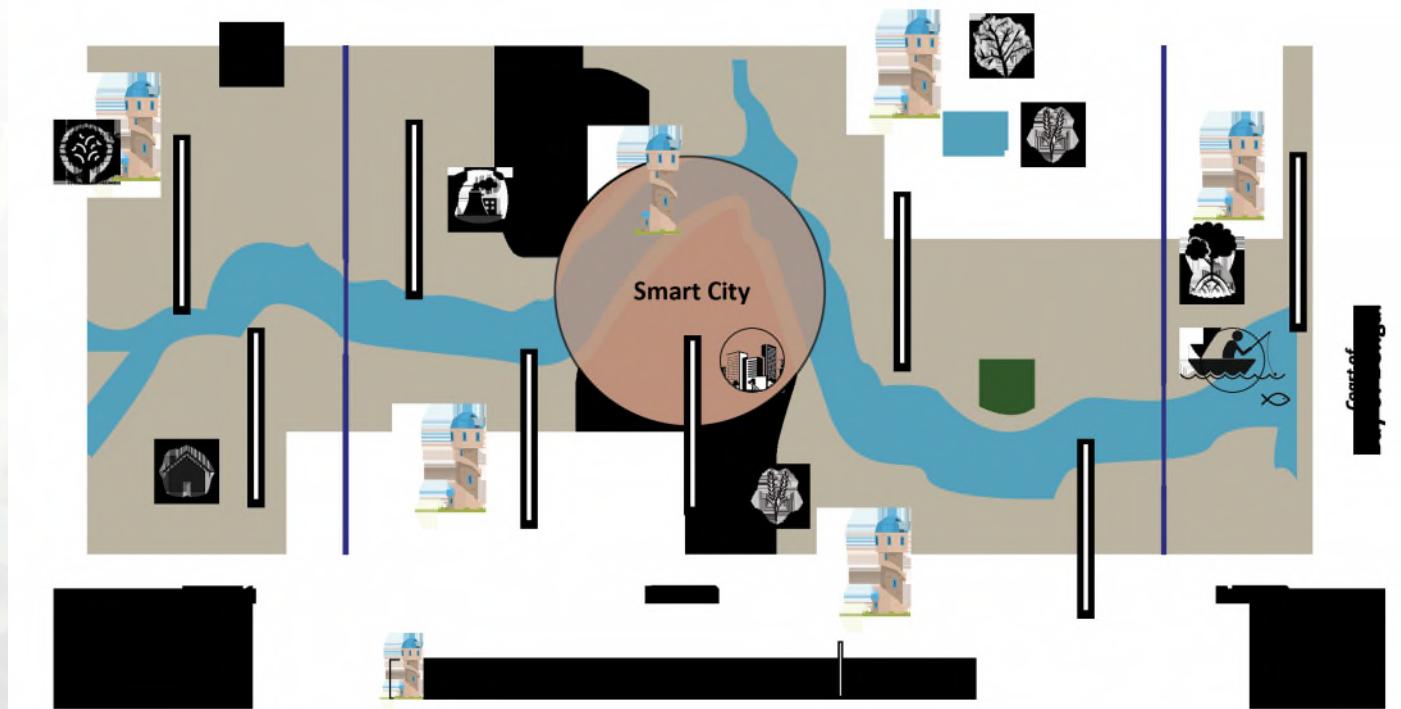


Figure 10. Proposed locations of the Social - Ecological Observatories for monitoring and evaluation

Outcomes

The outcomes of restoration strive to get agreed co-reference that set out for with stakeholders to for both at riverscape -scale and at local scale and which reflects improved ecological flow, reduced pollution and improved biodiversity and livelihoods,



Governance Structure of TamiraSES

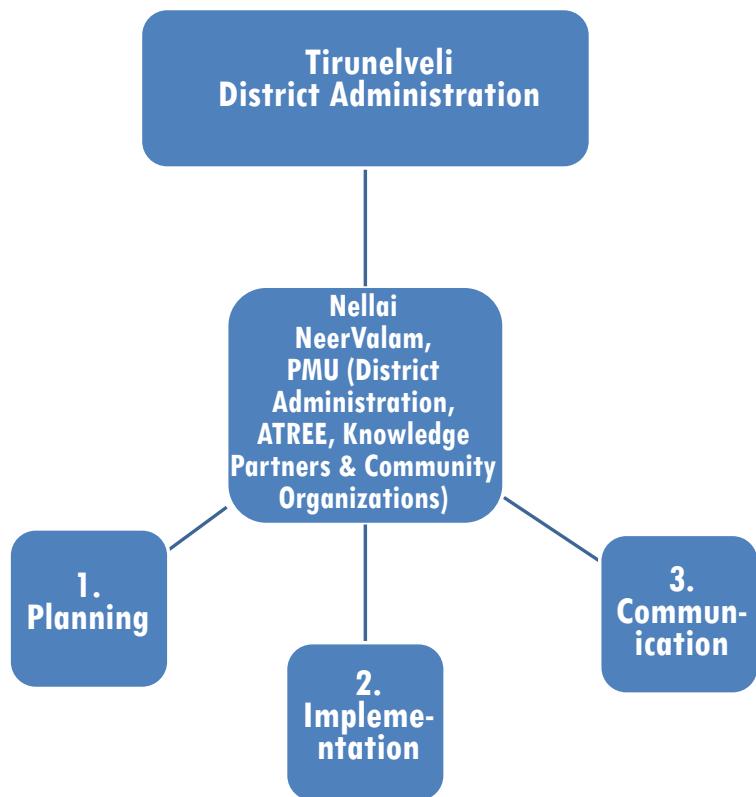


Figure 11. Proposed structure of governance to achieve step-wise goals of Tamiraparani Restoration





ATREE's
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